CLAIMS

What is claimed is:

1. A method for estimating a wireless channel in a time division duplex communication system using code division multiple access, the system associated with N midamble sequences, the wireless channel existing between a single transmitter and a single receiver, the single transmitter transmitting K communication bursts in a shared spectrum in a time slot, each burst having an associated midamble sequence of the N sequences, the receiving knowing the N midamble sequences, the method comprising:

receiving a vector corresponding to the transmitted midamble sequences of the K communication bursts at the single receiver;

constructing a matrix having N identical right circulant matrix blocks based in part on the known N midamble sequences; and

estimating the wireless channel based on in part one of the N blocks and the received vector.

2. The method of claim 1 wherein the wireless channel estimating is performed using a least squares solution.

3. The method of claim 2 wherein the least squares solution is implemented using a single cyclic correlator.

4. The method of claim 2 wherein the least squares solution is implemented using a discrete fourier transform solution.

5. The method of claim 1 wherein N is a maximum number of midamble codes associated with the system.

6. The method of claim 1 wherein N is a number of different midambles transmitted in the K bursts.

7. The method of claim 1 wherein a dimension of the estimation is a length of a channel response of the wireless channel.

8. A receiver for use in a wireless time division duplex communication system using code division multiple access, the system associated with N midamble sequences, a single transmitter in the system transmits K communication bursts in a shared spectrum in a time slot, each burst having an associated midamble sequence of the N sequences, the receiver knowing the N midamble sequences, the receiver comprising:

an antenna for receiving the K communication bursts including a vector corresponding to the transmitted midamble sequences of the bursts;

a channel estimator for constructing a matrix having N identical right circulant-matrix blocks based in part on the known N midamble sequences and estimating the wireless channel between the receiver and the single transmitter based on in part one of the N blocks and the received vector; and

a data detector for recovery data from the received communication bursts using the estimated wireless channel.

9. The receiver of claim 8 wherein the data detector is a multiuser detector.

10. The receiver of claim 8 wherein the data detector is a single user detector.

11. The receiver of claim 8 wherein the wireless channel estimating is performed using a least squares solution.

12. The receiver of claim 11 wherein the least squares solution is implemented using a discrete fourier transform solution.

13. The receiver of claim 11 wherein the least squares solution is implemented using a single cyclic correlator.

14. A wireless spread spectrum communication system using code division multiple access associated with N midamble sequences, the system communicating using communication bursts, each burst having an associated midamble sequence, the system comprising:

a base station comprising:

a data generator for generating data;

a plurality of modulation/spreading devices for formatting the generated data into K communication bursts time multiplexed to be in a same time slot and in a shared spectrum; and

an antenna for radiating the K communication bursts; and

a user equipment comprising:

an antenna for receiving the K communication bursts including a vector corresponding to the transmitted midamble sequences of the bursts;

a channel estimator for constructing a matrix having N identical right circulant matrix blocks based in part on the N midamble sequences and estimating the wireless channel between the base station and the user equipment based on in part the K block matrix and the received vector; and

a data detector for recovering data from the received communication bursts using the estimated wireless channel.

15. The system of claim 14 wherein the data detector is a multiuser detector.

16. The system of claim 14 wherein the data detector is a plurality of single user detectors.

17. The system of claim 14 wherein the wireless channel estimating is performed using a least squares solution.

18. The system of claim 17 wherein the least squares solution is implemented using a discrete fourier transform solution.

19. The system of claim 17 wherein the least squares solution is implemented using a single cyclic correlator.

20. The system of claim 14 wherein the base station is effectively transmitting data at a 2 Mbps data rate to the user equipment.